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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/649,958	08/28/2003	Mohamad A. Shaheen	42P14710	7075

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EXAMINER
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WILSON, CHRISTIAN D

ART UNIT	PAPER NUMBER
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2829

DATE MAILED: 02/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/649,958

Applicant(s)

SHAHEEN ET AL.

Examiner

Christian Wilson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-56 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-56 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>08282003</u> | 6) <input checked="" type="checkbox"/> Other: <u>search history</u>                    |

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because they contain hand drawn labels and figures.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. Claim 27 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
4. Claim 27 recites the limitation "micro-voids" in line 2. There is insufficient antecedent basis for this limitation in the claim. For the purposes of examination, it will be assumed that claim 27 should depend from claim 26.

***Official Notice***

5. Official notice is taken of the following material properties:

Band gap energy ( $E_g$ ) of silicon (Si) = 1.12 eV

Band gap energy ( $E_g$ ) of silicon germanium (SiGe) < 1.00 eV

These properties were taken from Sze (*Physics of Semiconductor Devices*, pg. 850) and People (*Physics and Applications of  $Ge_xSi_{1-x}/Si$  Strained-Layer Heterostructures*, Figures 10 and 11).

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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7. Claims 1, 2, 5 – 8, 19, 20, 23 – 25, and 28 – 56 are rejected under 35 U.S.C. 102(b) as being anticipated by Henley *et al.*

Henley *et al.* (US 6,290,804) discloses a method comprising impinging laser energy [column 7, line 17] on a substrate **10** and effecting laser-induced cleaving of the substrate [column 7, line 14].

Regarding claim 2, Henley *et al.* further discloses effecting a predetermined material within the substrate to form a predetermined cleave layer **24**, and effecting laser-induced cleaving within the cleave layer [column 4, lines 50-60].

Regarding claim 5, Henley *et al.* further discloses the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 6, Henley *et al.* further discloses stoichiometrically designing a composition of the material to substantially match a bond breaking energy involving the material to the laser energy and selecting the predetermined laser energy to match the bond-breaking threshold energy of the material [column 3, lines 35-55].

Regarding claim 7, Henley *et al.* further discloses balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 8, Henley *et al.* further discloses bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

Regarding claim 19, Henley *et al.* further discloses impinging the laser energy on the side edge of the substrate [Figure 7].

Regarding claim 20, Henley *et al.* further discloses effecting a predetermined material within the substrate to form a predetermined cleave layer **24**, and effecting laser-induced cleaving within the cleave layer [column 4, lines 50-60].

Regarding claim 23, Henley *et al.* further discloses the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 24, Henley *et al.* further discloses stoichiometrically designing a composition of the material to substantially match a bond breaking energy involving the material to the laser energy and selecting the predetermined laser energy to match the bond-breaking threshold energy of the material [column 3, lines 35-55].

Regarding claim 25, Henley *et al.* further discloses balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 28, Henley *et al.* further discloses bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

Regarding claims 29 – 56, Henley *et al.* discloses a silicon-on-insulator device in an electronic package [column 1, lines 15-25]. It is noted that product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious

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from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) Since the recited structure of claims 29 – 56 is the same as the product as disclosed by Henley *et al.*, the claims is unpatentable over Henley *et al.*

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 3, 4, 21, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Roche.

Henley *et al.* further teaches a silicon substrate [column 3, line 61] and a predetermined material which is hydrogen [column 4, line 35], but does not discuss a predetermined material which is germanium or a laser with an energy greater than the band gap of SiGe or smaller than Si or is infrared. Roche (US 2003/0162367) teaches a Nd:YAG laser which is an infrared laser with an energy of 1.06 eV and a Ge material [0065, 0026]. It would have been obvious to one of ordinary skill in the art to use the laser and material of Roche since Roche teaches that the laser and material provides short pulses which are absorbed in the weakened zone of the material.

10. Claims 9 – 12 and 15 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Choo *et al.*

Regarding claims 9 – 11, Henley *et al.* teaches laser-induced cleaving but does not discuss plural interfering laser beams with specifically tuned energies that forms a interference profile. Choo *et al.* (US 6,653,210) teaches a multiple laser cleaving method with tuned energies that forms an profile to the depth of the desired cleave plane [column 6, lines 5-10]. It would have been obvious to one of ordinary skill in the art to use the laser method of Choo *et al.* in the method of Henley *et al.* since the cutting speed can be controlled and increased by the multiple beams [column 4, lines 40-45].

Regarding claim 15, Henley *et al.* further teaches the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 16, Henley *et al.* further teaches stoichiometrically designing a composition of the material to substantially match a bond breaking energy involving the material to the laser energy and selecting the predetermined laser energy to match the bond-breaking threshold energy of the material [column 3, lines 35-55].

Regarding claim 17, Henley *et al.* further teaches balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 18, Henley *et al.* further teaches bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

11. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* and Choo *et al.* as applied to claim 12 above, and further in view of Roche.



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Henley *et al.* further teaches a silicon substrate [column 3, line 61] and a predetermined material which is hydrogen [column 4, line 35], but does not discuss a predetermined material which is germanium or a laser with an energy greater than the band gap of SiGe or smaller than Si or is infrared. Roche (US 2003/0162367) teaches a Nd:YAG laser which is an infrared laser with an energy of 1.06 eV and a Ge material [0065, 0026]. It would have been obvious to one of ordinary skill in the art to use the laser and material of Roche since Roche teaches that the laser and material provides short pulses which are absorbed in the weakened zone of the material.

12. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Nakano *et al.*

Henley *et al.* teaches an ion implantation method with hydrogen which forms micro-defects at the cleave plane [column 4, lines 60-65], but does not discuss forming micro-voids. Nakano *et al.* (US 2003/0153162) teaches an implantation method which forms micro-voids [0024]. It would have been obvious to one of ordinary skill in the art that the method of Henley *et al.* would produce the micro-voids of Nakano *et al.* at the cleave plane since Nakano *et al.* teaches that ion implantation causes micro-voids by channeling of ions in the material layer [0047].

### ***Conclusion***

13. A copy of the search history (EAST and STN) is enclosed.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian Wilson whose telephone number is (571) 272-1886.

The examiner can normally be reached on weekdays, 7:30 AM to 4 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'CW', is positioned above the printed name of the examiner.

Christian Wilson, Ph.D.  
Primary Examiner  
Art Unit 2829

CDW